

REMARKS

Applicant respectfully requests reconsideration. Claims 1-27, 29-41 and 43-46 were previously pending in this application. No amendments have been made to the claims. As a result, claims 1-27, 29-41 and 43-46 are pending for examination with claims 1 and 29 being independent claims. No new matter has been added.

Rejections Under 35 U.S.C. § 103

The Examiner rejected claims 1 to 27, 29 to 41 and 43 to 46 under 35 USC § 103(a) as being unpatentable over Hazarika et al (WO 02/00812) in view of Allen et al (WO 97/44414). Applicant respectfully requests reconsideration.

The Examiner has argued on page 6 of the Office Action that “*it would be obvious to one of ordinary skill in the art to use the succinimide and various fuel additives of ALLEN in the fuel composition of HAZARIKA et al. because the succinimide and various fuel additives are stable systems that are cooperatively effective in fuels for improving the operation of diesel engine particulate traps as taught by ALLEN (page 2-3)*” (emphasis added).

Applicant respectfully disagrees with the Examiner. A person skilled in the art would not expect a succinimide or other detergent disclosed in Allen et al to be cooperatively effective or to have any kind of synergistic effect with the cerium oxide particles described in Hazarika et al, whether for improving the operation of diesel engine particulate traps or otherwise. Rather, a person skilled in the art would, at best, expect the cerium oxide and the detergent to perform their known function without any additional benefit.

Allen et al discloses a fuel soluble composition comprising a detergent and a combustion improver, which is for use in a process to reduce liner lacquering in marine diesel engines. An

essential feature of the composition in Allen et al is that it is fuel soluble. In order to provide a fuel soluble composition it is evident to a person skilled in the art that the combustion improver itself must also be fuel soluble. That is because the rare earth metal salts of alkyl or cycloalkyl carboxylic acids described on page 5, lines 9 to 10 of Allen et al (these are combustion improvers from US 4,522,631) are fuel soluble, as are the cerium oxidic compounds of formula (II) described on page 5, line 30 to page 6, line 1. As regards the fuel solubility of the cerium oxidic compounds of formula (II), the Examiner is directed to US 5,449,387, which discloses examples of the cerium oxidic compounds and methods for their preparation. US 5,449,387 describes the cerium oxidic compounds as being “surprisingly soluble in apolar solvents”, see column 4, lines 53 to 54.

Since Allen et al teaches that it is essential for the combustion improver to be fuel soluble in order to be effective in reducing liner lacquering in marine diesel engines, then a person skilled in the art would not seek to use insoluble particles of a lanthanide oxide with a detergent as part of a fuel soluble composition. Thus, a skilled worker would not have a reason to, and certainly would not, use a detergent in combination with non-coated cerium oxide particles, as described in Hazarika et al.

In addition, it would not be obvious to use the lipophilic coated lanthanide oxide particles disclosed in Hazarika et al with a detergent from Allen et al.

Hazarika et al teaches that the lipophilic coating aids dispersion of the particles in fuel (see page 5, lines 21 to 23). Notably, Hazarika does not claim that all of the lanthanide oxides in particle form are solubilized in fuel by the lipophilic coatings. Rather, “the lipophilic coating allows complete solubilisation of the lanthanide oxide in fuel” only “[i]n some cases”, see page 5 lines 23 to 24. A person skilled in the art would therefore expect lipophilic coated cerium oxide particles to be dispersible in fuel, but not necessarily be fuel soluble. In the absence of a clear and unambiguous teaching in Hazarika et al that the coated cerium oxide particles are fuel soluble, a person skilled in the art would not seek to combine them with a detergent from Allen et al.

Furthermore, a person skilled in the art would not obviously combine the coated cerium oxide particles from Hazarika et al with a detergent from Allen et al because it appears that there is a general chemical incompatibility between the coating on the particles and the detergent. An important teaching of Hazarika et al is that the coating should only break down immediately upon entry to the combustion chamber of an internal combustion engine and not beforehand (see page 6 lines 16 to 19). This is to prevent formation of solid deposits during storage of the fuel (see page 5, lines 24 to 27). The lipophilic coatings disclosed in Hazarika et al are low HLB (hydrophilic/lipophilic balance) surfactants that are alkyl carboxylic acids, anhydrides or esters (see page 6 lines 8 to 11). Detergents are notably absent from the list of additives in Hazarika et al that may be added to the fuel in addition to the lanthanide oxide particles (see page 6, lines 24 to 31).

Allen et al discloses diesel detergents that are "amines, imidazolines, amides, fatty acid succinimides, polyalkylene succinimides, polyalkylene amines and polyether amines" (see the paragraph bridging pages 2 and 3). Most of the detergents disclosed in Allen et al have a nucleophilic amine moiety (for example, see the definitions of X and Y for formula (I) on page 3). As the Examiner will appreciate, amines are able to react with the carboxylic acid, anhydride or ester group present in the lipophilic coating of the lanthanide oxide particles disclosed in Hazarika et al to form an amide. Amides are not listed in Hazarika et al as being suitable lipophilic coatings and presumably they would not assist in dispersing the particles in a fuel. In such circumstances, breakdown of the coating has effectively occurred in the fuel tank before the fuel has entered the combustion chamber of an internal combustion engine, which is contrary to the teaching of Hazarika et al.

When the coating contains a carboxylic acid group, then the detergent itself may be affected. The nucleophilic amine moiety may be protonated by the acid to form an ammonium salt. The ammonium salt formed would precipitate out and produce a solid deposit in the fuel. Hydrolysis of any amide or imide group present in the detergent may also occur.

A person skilled in the art would not therefore combine a detergent from Allen et al with the coated lanthanide oxide particles of Hazarika et al with a reasonable expectation of success.

Finally, it is well established when considering the obviousness of a combination of known elements, the operative question is “whether the improvement is more than the predictable use of prior art elements according to their established functions”. KSR International Co. v. Teleflex, Inc., 550 U.S. 398, 82 USPQ2d 1385, 1395-96 (2007).

Cerium oxide is typically included as an additive in fuel to act as a catalyst in the reduction of toxic exhaust gases produced on combustion of a fuel. For diesel engines, the cerium oxide also burns off particulates which accumulate in the traps of diesel engines after combustion of diesel fuel (see paragraph bridging pages 1 and 2 of the present application). As explained previously, detergents are added to fuels to reduce or prevent the accumulation of hydrocarbon deposits in the combustion chamber and/or intake valves of an engine.

Normally, cerium oxide is added to fuel in a vehicle shortly before the fuel enters the engine to minimize solid separation of the particles from the fuel. The addition of cerium oxide in this manner may be achieved by equipping a vehicle with an onboard dosing system (see page 2, lines 5 to 10 of the present application). It has been found that by adding both cerium oxide and a detergent to a fuel prior to the introduction of the fuel into a vehicle that there is an improvement in fuel economy. The improvement seems to be based on the surprising effect that the detergent has on the dispersibility of the cerium oxide in the fuel. As shown in Examples 2 to 4 of the application, the addition of both a detergent and a cerium oxide results in the prevention of, or a significant reduction in, solid separation of the fuel additive from the fuel.

A person skilled in the art would not expect or predict a detergent to have any effect on the dispersibility of the cerium oxide. Cerium oxide is an ionic, hydrophilic compound. Detergents, on the other hand, are generally included in fuels to solubilize and assist in the removal of hydrocarbon deposits, which are hydrophobic compounds. It is surprising therefore that the detergent has a

beneficial effect on the cerium oxide, especially given the difference in the chemical characteristics of cerium oxide compared to hydrocarbon deposits. There is nothing in either Hazarika et al or Allen et al, or in the combination of these cited references, that suggest combining a detergent with particles of cerium oxide, or that there would be any benefit in doing so. Accordingly, the invention claimed in the present application is not obvious from the combination of the cited prior art.

It is noted that neither Hazarika et al nor Allen et al discloses a method that comprises adding doped cerium oxide to a fuel. Thus, the embodiment in claim 1 that relates to doped cerium oxide is not obvious from the combination of Hazarika et al and Allen et al. for this additional reason.

Accordingly, Applicant respectfully submits that all of the objections have been overcome and that the application is in order for allowance.

CONCLUSION

In view of the foregoing, the present application is believed to be in condition for allowance. A Notice of Allowance is respectfully requested. The Examiner is requested to call the undersigned at the telephone number listed below if this communication does not place the application in condition for allowance.

If this response is not considered timely filed and if a request for an extension of time is otherwise absent, any necessary extension of time is hereby requested. If there is a fee occasioned by this response, including an extension fee, the Director is hereby authorized to charge any deficiency or credit any overpayment in the fees filed, asserted to be filed or which should have been filed herewith to our Deposit Account No. 23/2825, under Docket No. K0181.70020US00.

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